

# Impact of Single Vs Multiple Basic and Advanced Cardiac Life Support Training Programs to Residents on the Outcome of Cardiopulmonary Resuscitation

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## ABSTRACT

**Introduction:** In recent years, cardio-pulmonary resuscitation has received much attention. Formal training programs are conducted based on these guidelines. Less data is available in the literature highlighting the impact of these trainings on cardiopulmonary resuscitation outcome. Aim of our study is to evaluate the impact and outcome of basic and advanced cardiac life support programs to obtain return of spontaneous circulation and patient survival to discharge by cardiopulmonary resuscitation.

**Material and Methods:** This retrospective study was conducted over 12-month period. All in hospital adult cardiac arrest victims with single - training period (July 2015 to December 2015) as period-1 and repeated training period on- basic and advanced cardiac life support training as period-2 (January 2016 to June 2016) were included in this study. We compared the outcomes and results of cardiopulmonary resuscitation between these two study periods.

**Results:** All 241 patients admitted in the hospital. In the single basic and advanced cardiac life support training (period-1) 29 patients (25.44%) had return of spontaneous circulation, compared with patients 45 (35.43%) in the multiple- basic and advanced cardiac life support training (period-2) ( $P < 0.005$ ). Survival to hospital discharge was also significantly higher in training period -2 (8 patients, 6.3%) than in the period-1 (4 patients 3.5%).

**Conclusion:** The rate of return of spontaneous circulation and survival to discharge are improved with quality of cardiopulmonary resuscitation and post-resuscitation care. Factors influencing the immediate outcome of cardiopulmonary resuscitation are the strategic planning and repeated orientation trainings.

**Keywords:** Basic life support; advanced cardiac life support, Cardiac arrests; Return of spontaneous circulation; Survival to discharge; Cardiopulmonary resuscitation.

## INTRODUCTION

At present cardiopulmonary resuscitation (CPR) has received more importance. Various accepted guidelines for CPR have been published, and on this basis training programs are being conducted by certified training centers. Early detection of cardiac arrest and cardiopulmonary resuscitation (CPR) of arrest victim can improve the likelihood of survival. The foundations for CPR are basic life support (BLS) and advanced cardiac life support (ACLS).<sup>1,2</sup> Cardio-pulmonary resuscitation is often ineffectively performed despite widespread training according to the guidelines.<sup>3,4</sup> Health care givers must be proficient in BLS and ACLS protocols to detect and manage these emergencies. Cardiopulmonary resuscitation and emergency cardiovascular care guidelines are regularly renewed and published by the American Heart Association and European regulation council every five years. However, only few evaluative studies are available in the literature. This study was undertaken to evaluate

the long-term impact of formal certified CPR training program among the residents.

## MATERIAL AND METHODS

Ours is a 960 bedded teaching hospital. All healthcare professionals and PG students/residents were provided in-hospital BLS and ACLS training. They initiated CPR whenever there was a cardiac arrest in the hospital and continued till the arrival of the code blue team. The code blue team consisted of an emergency medicine registrar/resident or anesthesiology registrar/resident, a medicine registrar/resident, other resident medical officer, staff nurse and nursing supervisor. The hospital policy is to always initiate CPR in a cardiac arrest victim. A code blue running sheet was filled by a record keeper during the CPR period.

## Intervention

Training programme with AHA guidelines for CPR had been conducted with the aim of improving CPR skills. The courses included various lectures and hands-on training of peri-arrest case scenarios, which were followed by a written test and skill assessments. All the residents working in the emergency and intensive care units participated in the course.

## Study design

After getting approval from the Institutional ethical committee, we designed a retrospective study and evaluated the effectiveness of the above intervention on the outcome of CPR in hospital cardiac arrest cases.

Cardiac arrest was defined by the absence of a detectable pulse or by patient's unresponsiveness or by any arrest rhythm noticed on the cardiac monitors.<sup>5</sup>

We identified all cases of in hospital cardiac arrest in adults (>14 years of age) that occurred over a 12 months period. Data regarding each cardiac arrest were collected from the code blue running sheets. We compared the data from July 2015 to December i.e. single ACLS training period, with repeated-ACLS training period from January 2016 to June 2016.

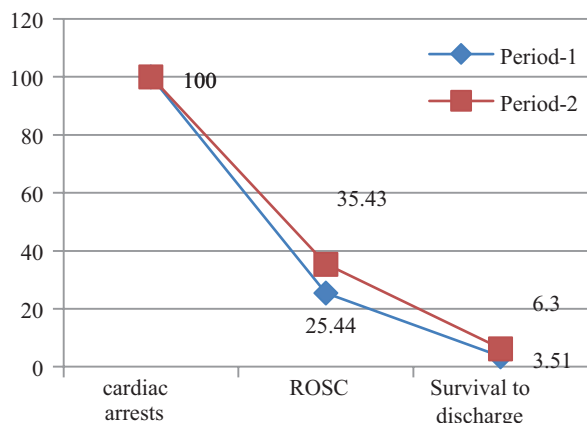
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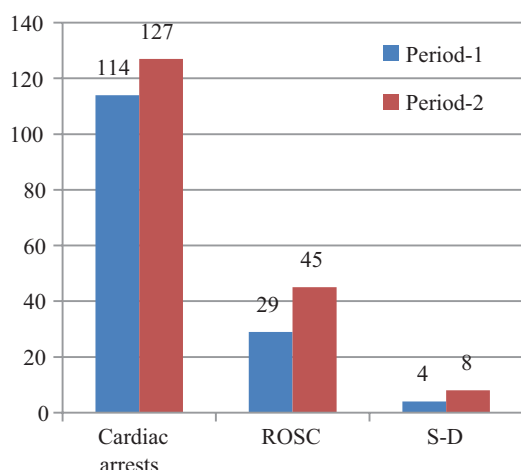
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**Inclusion criteria:** When patients suffered cardiac arrest in the hospital, or after arrival to the emergency room only included in the study analysis for avoiding falsely elevated rate of successful CPR, or falsely diminished rate of survival to hospital discharge.

**Exclusion criteria:** The patients on whom CPR was started after second arrest were not included in the study. The outcomes of interest were immediate survival after CPR and survival to



**Figure-1:** percentage of Cardiac arrests, ROSC and arrests to survival discharge during both the periods in graph form.



**Figure-2:** Cardiac arrests, ROSC and Survival during both the periods in chart form.

Period	Period-1 (n=114)	Period-2 (n=127)	p-value
Age of patients	43.69± 14.68	42.53± 14.71	0.843
Male	65(57.02%)	72(56.69 %)	0.6764
Female	49 (42.98 %)	55(43.31 %)	0.6818

Table 1- Demographic data shows of the 114 cardiac arrest victims during the single-BLS/ACLS training period, in that 65 were male and 49female and during multiple BLS/ACLS training period out of 127, of which 72 were male and 55 were female. The demographic figures show that they are statistically not significant.

**Table-1:** Demographic data

Period	Period-1(n114)	period-2(N=127)	p-value	p-value% wise
ROSC	29 (25.44%)	45 (35.43%)	<0.00001	<0.001
ROSC- Survival	4(13.79%)	8(17.78%)	0.0174	<0.001
Survived to-Discharge	4 (3.51%)	8(6.3%)	0.0174	0.004

Table-2- shows p- value taken on number basis and percentage basis as it is not a number control study, but results are very significant.

**Table-2:** Outcomes of cardiopulmonary resuscitation

hospital discharge. Immediate survival was defined as the return of spontaneous circulation (ROSC) for more than 20 min.

**STATISTICAL ANALYSIS**

The relevant data was entered into the excel sheets and was analyzed using Info software. Chi square test was used to compare the immediate survival rates-ROSC and survival to hospital discharge rates in the BLS/ACLS single training period and -BLS/ACLS multiple training periods. For all statistical analysis,  $P<0.05$  was considered to be significant.

**RESULTS**

A total of 241 adult patients suffering in hospital cardiac arrest for the first during the study period were included in this study. CPR was attempted in 114 patients during single BLS/ACLS training period -1and 127 patients in the multiple-BLS/ACLS training period-2.

During the single-BLS/ACLS training period 29 patients (25.44%) had ROSC, while during the multiple-BLS/ACLS training period, 45 patients (35.43%) of 127 patients had ROSC. On statistical analysis, this was considered to be a significant difference in the immediate survival rate ( $P = 0.00001$ ). Of the 29 patients who had ROSC during the single-BLS/ACLS training period, only 4 patients (3.51%) were survived and discharged from the hospital. During the multiple-BLS/ACLS training period, of the 45 ROSC patients, 8patients (6.3 %) were survived and discharged from hospital. The survival to hospital discharge rate after the multiple-BLS/ACLS training period was statistically significant ( $P< 0.041$ ) when compared with the single-BLS/ACLS training period.

**DISCUSSION**

In-hospital cardiac arrest is an emergency situation that requires teamwork and the appropriate sequential actions to rescue the patients.<sup>6</sup> The outcome of cardiac arrest and CPR is dependent on critical interventions, like early effective chest compressions, assisted ventilation and defibrillation.<sup>7</sup> Over the last 56 years, after the introduction of modern CPR by Peter Safar,<sup>8</sup> there have been major developments and changes in the performance of resuscitation.<sup>9</sup> But, despite considerable efforts to improve the treatment of cardiac arrest, most reported survival outcome figures are poor. Even in the hospitalized patients, the rate of successful CPR has been reported by some studies to be as low as 2–6% in critical cases,<sup>9</sup> although most studies report successful CPR outcome in the range of 13–59% in non-critical cases.<sup>10</sup>

The poor resuscitation skills of doctors in basic and advanced life support have been identified as contributing factors for poor outcome in cardiac arrest victims.<sup>11</sup> in an effort to improve cardiac arrest outcomes, recent guidelines have focused on the timing and quality of CPR. Most of the training programmes based on these guidelines have become a standard in all medical institutions. The aim of these courses is to provide information

and hands-on practice in the management of peri-arrest situations in accordance with the latest guidelines.

The results of the present study show that the rate of immediate survival was 25.44% during the single-BLS/ACLS period, which increased to 35.43% during the multiple-BLS/ACLS period. The rates of ROSC during both the study periods were clearly indicating an improved rate of immediate survival after the formal BLS/ACLS training ( $P < 0.00001$ ). A Brazilian study by Moretti et al. also showed a significant increase in ROSC from 27.1% to 43.4% even on inclusion of a single ACLS-trained personnel in the resuscitation team.<sup>12</sup> Study by Sanders' also reported improved resuscitation success in a rural community hospital after an ACLS provider course.<sup>13</sup> Borimnejad et al. also showed that initial survival after CPR improved significantly with the CPR-trained emergency team (18.4–30%).<sup>9</sup>

Study by Moretti et al. reported an increase in survival in patients resuscitated by the CPR team, who were having an ACLS-trained personnel versus the team having no ACLS personnel (20.6% vs. 31.7%).<sup>14</sup> Our study reports markedly improved survival to hospital discharge rates (25.44% vs. 35.43%) after multiple periodical BLS/ACLS training ( $P < 0.00001$ ). The survival to discharge rates during the single-BLS/ACLS period of our study are almost comparable to that reported in the literature (3.5%–6.3%), but the significant increase in survival to discharge rates after multiple BLS/ACLS training from 13.79 to 17.78% highlights that formal multiple training of code blue team members and Care after ROSC. The skills of CPR and their level of competence in resuscitation and post care improved after repeated ACLS training. Slightly low results are due rural hospital, low patient education, late patient arrival, op-poisoning, snake bite cases, critical illness and chronic terminal diseases with multi-organ failure. Our improved results also shows that the quality of CPR performed might be better after multiple ACLS trainings. This highlights the importance of hands-on training programme on the outcome of resuscitation and repeated certification. Cardiac arrests to ROSC indicates effectiveness CPR and defibrillation and ROSC or Survival to discharge indicates effectiveness ACLS and subsequent treatment to the patient and condition before the arrest.

**Limitations of the study:** Limitations of our study, it was conducted at a single Institution. Multicenter studies are required to ascertain the validity. Second, our results improved because of increased awareness on resuscitation during the multiple-training period.

## CONCLUSIONS

Successful resuscitation after cardiac arrest requires early recognition, rapid activation of trained responders/residents, timely initiation of BLS, early defibrillation and following ACLS protocols. Our study reveals that formal training of the CPR team improves the survival rates and survival to hospital discharge but multiple orientation hands on training improves performance and better results in cardiac arrest victims.

We conclude that the rate of ROSC and survival to discharge improves with quality of CPR and post-resuscitation care. Several factors can be used to predict the immediate outcome of CPR including the strategic planning and repeated orientation trainings.

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